

WHAT IS CLAIMED IS:

1           1. A method for controlling at least one of an  
2       automated clutch and an automated transmission in a motor  
3       vehicle, wherein a target value for a clutch torque is  
4       determined by means of an electronic clutch management system  
5       as an output quantity of a start-up function, dependent on  
6       suitable input quantities.

1           2. The method according to claim 1, wherein said  
2       suitable input quantities include at least one of the group  
3       consisting of accelerator pedal angle, engine rpm-rate,  
4       transmission input rpm-rate, and engine torque.

1           3. The method according to claim 2, wherein the  
2       start-up function is substantially divided into at least two  
3       phases by means of a factor calculation.

1           4. The method according to claim 3, wherein in a  
2       first phase of said two phases the engine rpm-rate is  
3       substantially matched to a target value (a\_start) of a  
4       starting rpm-rate in order to regulate the starting rpm-rate,  
5       and in a second phase of said two phases, the engine rpm-rate  
6       is synchronized with the transmission input rpm-rate.

1               5. The method according to claim 1, wherein for said  
2 determination of the target value for the clutch torque, a  
3 global torque contribution is determined by means of a global  
4 control.

1               6. The method according to claim 5, wherein the  
2 global torque contribution is determined as a combination of  
3 a plurality of contributions.

1               7. The method according to claim 6, wherein at least  
2 one of said plurality of contributions is determined as a  
3 function of at least one of the transmission input rpm-rate  
4 and the engine rpm-rate.

1               8. The method according to claims 7, wherein one of  
2 said plurality of contributions comprises an engine-torque-  
3 dependent contribution ( $KME*Me$ ) .

1               9. The method according to claim 8, wherein said  
2 engine-torque-dependent contribution is weighted with an rpm-  
3 ratio (SR) conforming to the equation  $SR = n_{trsm}/n_{eng}$ , so  
4 that when synchronism is achieved at the clutch, the engine-

5 torque-dependent portion is substantially fully effective.

1 10. The method according to claim 9, wherein the  
2 weighted engine-torque-dependent contribution ( $SR*KME*Me$ ) is  
3 subject to a limitation of its time gradient.

1 11. The method according to claim 10, wherein said  
2 plurality of contributions is supplemented by at least one  
3 controller contribution in order to ensure the performance of  
4 phase-specific tasks in the start-up function.

1 12. The method according to claim 9, wherein at  
2 lower values of the rpm-ratio (SR) priority is given to  
3 regulating a start-up rpm-rate ( $n_{start}$ ) in accordance with a  
4 target value and wherein said start-up rpm-rate is  
5 determined by means of a characteristic curve at least as a  
6 function of an accelerator pedal angle.

1 13. The method according to claim 12, wherein the  
2 start-up rpm-rate is further processed through a filter.

1 14. The method according to claim 13, wherein said  
2 filter comprises a low-pass filter.

1               15. The method according to claim 13, wherein the  
2 filter is initialized with the engine rpm-rate ( $n_{eng}$ ) if the  
3 engine rpm-rate ( $n_{eng}$ ) in neutral gear considerably exceeds  
4 an idling rpm-rate.

1               16. The method according to claim 11, wherein a  
2 weighted difference ( $f_1(SR) * (n_{start} - n_{eng})$ ) with a weight  
3 factor  $f_1(SR)$  being a function of the rpm-ratio (SR) is  
4 converted through a proportional/integrating controller into  
5 a contribution to a target value for the clutch torque  
6 ( $M_{Rtrgt}$ ).

1               17. The method according to claim 9, wherein at  
2 higher values of the rpm-ratio (SR) priority is given to  
3 attaining synchronism and a proportional/integrating  
4 controller is used, wherein a weighted difference ( $f_2$   
5 ( $SR) * (n_{eng} - n_{trsm})$ ) with a weight factor  $f_2(SR)$  being a  
6 function of the rpm-ratio (SR) serves as an input signal to  
7 the proportional/integrating controller and is converted into  
8 a contribution to a target value for the clutch torque  
9  $M_{Rtrgt}$ .

1           18. The method according to claim 16, wherein a  
2 first weighted difference ( $f_1(SR) * (n_{start} - n_{eng})$ ) and a  
3 second weighted difference ( $f_2(SR) * (n_{start} - n_{eng})$ ) with  
4 weight factors  $f_1(SR)$  and  $f_2(SR)$  being functions of the rpm-  
5 ratio (SR) are each converted by their own  
6 proportional/integrating controller into a contribution to a  
7 target value for the clutch torque ( $M_{Rtrgt}$ ), and wherein the  
8 respective integrating portions of the two  
9 proportional/integrating controllers are implemented by a  
10 joint integrator.

1           19. The method according to claim 18, wherein an  
2 additional integrator is used in addition to the joint  
3 integrator.

1           20. The method according to claim 19, wherein the  
2 additional integrator is arranged in series with the joint  
3 integrator, and wherein the additional integrator uses a  
4 comparatively small amplification parameter (KI3).

1           21. The method according to claim 19, wherein the  
2 target value for the clutch torque ( $M_{Rtrgt}$ ) determined as  
3 the output quantity is subject to a limitation.

1                   22. The method according to claim 21, wherein in  
2                   limiting the target value for the clutch torque ( $M_{Rtrgt}$ ) at  
3                   least in a first phase where the target value for the clutch  
4                   torque ( $M_{Rtrgt}$ ) is low, a new start-up function is matched  
5                   to an existing start-up function, and the new start-up  
6                   function is allowed to diverge from the existing start-up  
7                   function only in a second phase where the target value for  
8                   the clutch torque ( $M_{Rtrgt}$ ) increases.

1                   23. The method according to claims 22, wherein in  
2                   limiting the target value for the clutch torque ( $M_{Rtrgt}$ ),  
3                   each integrator is subjected to a measure to avoid the so-  
4                   called wind-up.

1                   24. The method according to claim 23, wherein after  
2                   limiting the target value for the clutch torque ( $M_{Rtrgt}$ ),  
3                   an integral portion ( $M_I$ ) is calculated according to the  
4                   equation:  
5                    $M_I = M_{Rtrgt\_lim} - M_{glob} - M_D + M_{P1} + M_{P2}$ , wherein  
6                    $M_{Rtrgt\_lim}$  = limited target value for the clutch torque  
7                    $M_D$  = damping torque portion  
8                    $M_{P1}$  = proportional torque portion of the

9 proportional/integrating controller in the first phase, and  
10  $M_{P2}$  = proportional torque portion of the  
11 proportional/integrating controller in the second phase.

1 25. The method according to claim 24, wherein the  
2 damping torque portion ( $M_D$ ) is used in determining the  
3 start-up function.

1 26. The method according to claim 24, wherein the  
2 damping torque portion ( $M_D$ ) is used in at least one of  
3 regulating the starting rpm-rate during the first phase and  
4 synchronizing the engine rpm-rate with a transmission rpm-  
5 rate during the second phase.

1 27. The method according to one of claim 26, wherein  
2 at least one of the transmission input rpm-rate ( $n_{trsm}$ ) and  
3 the engine rpm-rate ( $n_{eng}$ ) is disregarded in determining the  
4 start-up function.

1 28. The method according to claim 22, wherein a  
2 throttle-valve-dependent portion ( $K(\alpha)$ ) is used in  
3 determining the start-up function.

1                   29. The method according to claims 28, wherein the  
2                   target value for the clutch torque ( $M_{Rtrgt}$ ) conforms to the  
3                   equation:

4                    $M_{Rtrgt} = K(\alpha) * f(n_{eng})$ , wherein  $f(n_{eng})$  represents a  
5                   function of the engine rpm-rate.

1                   30. The method according to one of claim 29, wherein  
2                   the time derivative of the clutch torque ( $M_{Rtrgt}$ ) conforms  
3                   to the equation:

4                   
$$\frac{d}{dt} M_{Rtrgt} = f(n_{eng}) * \frac{dK(\alpha)}{d\alpha} * \frac{d\alpha}{dt} + K(\alpha) * \frac{df(n_{eng})}{dn_{eng}} * \frac{dn_{eng}}{dt},$$
  
5

6                   wherein  $n_{eng}$  represents the engine rpm-rate and  $K(\alpha)$   
7                   represents the throttle-valve-dependent portion.

1                   31. The method according claim 30, wherein at least  
2                   one of the throttle-valve-dependent portion ( $K(\alpha)$ ) and the  
3                   engine-rpm-rate-dependent portion  $f(n_{eng})$  is subject to a  
4                   limitation of its respective time gradient.

1                   32. The method according to claim 31, wherein the  
2                   time gradient  $dK(\alpha)/dt$  is subject to a limitation designed to  
3                   reduce the influence of  $K(\alpha)$  in such a way that undesired  
4                   accelerations of the vehicle are avoided.

1                   33. The method according to claim 30, wherein a drop  
2    in the target value for the clutch torque ( $M_{Rtrgt}$ ) during an  
3    engine-load change as a result of an abrupt depression of the  
4    gas pedal is avoided by imposing a limitation on the time  
5    gradient ( $dK(\alpha)/dt$ ) .

1                   34. The method according to claim 30, wherein a  
2    sudden closing of the clutch during an engine-load change as  
3    a result of an abrupt let-up on the gas pedal is avoided by  
4    imposing a limitation on the time gradient ( $dK(\alpha)/dt$ ) .